6-1-2008

GIS Analysis: Re-routing Metro Parks service vehicles

Jason Pfingston
jasondpf@uw.edu

GIS Analysis: *Re-routing Metro Parks service vehicles*

University of Washington Tacoma IAS
Jason Pfingston

ABSTRACT

The purpose of this research was to create the most efficient driving routes for Metro Parks service vehicles using ESRI's ARC GIS software. Currently the Metro Parks service vehicles do not have predetermined routes, or any sort of tracking devices like GPS. The results of new efficient driving routes include reduced drive time, reduced fuel costs, and more accountability for drivers.

Scenarios Created

Three different mower scenarios were created, one for each mower that Metro Parks uses to maintain the parks throughout Tacoma.

Mowing Scenario 1

Park	Estimated Mow Time (hrs)	Mowing day scheduled	TOTALS
Wapato Park	3	MONDAY	
Manitou Park	2	MONDAY	21.4 miles,
South Park	2.5	MONDAY	7.5 hours mowing, 36 minute drive
Portland Ave Park	3	TUESDAY	21.1 miles,
Stewart Heights Park	4.5	TUESDAY	7.5 hours mowing, 37 minute drive
Stanley Park	1.5	WEDNESDAY	
Lincoln/Eldridge Park	2.5	WEDNESDAY	
Celebration Park	1.5	WEDNESDAY	23.1 miles,
Harmon Park	2	WEDNESDAY	7.5 hours mowing, 39 minute drive
Jane Clark	2	THURSDAY	
Kandle Park	1.5	THURSDAY	
Vassault Park	3.5	THURSDAY	6.1 miles, 7 hours mowing, 13 minute drive
Jefferson Park	3	FRIDAY	
Franklin Park	2	FRIDAY	10.9 miles, 5 hours mowing, 21 minute drive

Mowing Scenario 2

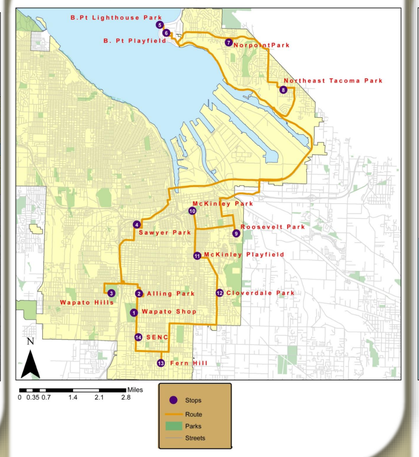
Park	Estimated Mow Time (hrs)	Mowing day scheduled	TOTALS
Browns Point Lighthouse	2	MONDAY	
Browns Point Playfield	1.5	MONDAY	
Norpoint Park	2	MONDAY	31.7 miles,
N/E Playfield	1.5	MONDAY	7 hours mowing, 52 minute drive
Alling Park	3.5	TUESDAY	
Wapato Hills Park	3.5	TUESDAY	7.4 miles,
Sawyer Park	1	TUESDAY	8 hours mowing, 15 minute drive
Roosevelt Park	2.5	WEDNESDAY	
McKinley Park	3	WEDNESDAY	14.8 miles,
Fern Hill Park	2	WEDNESDAY	7.5 hours mowing, 25 minute drive
Cloverdale Park	2.5	THURSDAY	
McKinley Playfield	3.5	THURSDAY	8.8 miles,
SENC (field behind)	1.5	THURSDAY	7.5 hours mowing, 18 minute drive

Mowing Scenario 3

Park	Estimated Mow Time (hrs)	Mowing day scheduled	TOTALS
Baltimore Park	1	MONDAY	3.7 miles,
Point Defiance Park	5	MONDAY	6 hours mowing, 9 minute drive
Vassault (Lower Section)	5.5	TUESDAY	11.7 miles,
Oakland Madrona Park	1.5	TUESDAY	7 hours mowing, 11 minute drive
Optimist Park	2	WEDNESDAY	11 miles,
Delong Park	1	WEDNESDAY	3 hours mowing, 19 minute drive

Scenario 1-- Jake Mower from Pt. Defiance
All Stops, for All Days

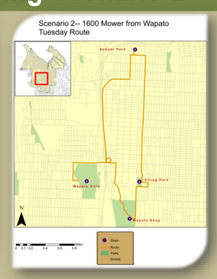
Scenario 2-- 1600 Mower from Wapato
All Stops, for All Days

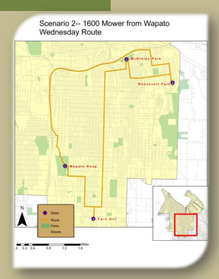


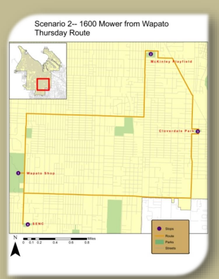
Scenario 3-- 1600 Mower from Point Defiance
All Stops, for All Days

Mowing Scenario 1

Mowing Scenario 2







Mowing Scenario 3

Results

Using ARC GIS the routes created will increase productivity, and reduce drive time and costs. The total miles driven for all routes will be 172. If the vehicle used gets 12 miles per gallon (and using $3 per gallon for the cost of gasoline), then the total cost for fuel for all routes combined will be $43 dollars.

Another way that travel costs could be lowered would be through overtime. Particularly on the scenario 3 routes, if the drivers were able to do 21 minutes of overtime on Monday, and 17 minutes of overtime on Tuesday, then the Wednesday route could be eliminated all together. This could raise issues with drivers not willing to do the overtime, or the cost of the overtime pay outweighing the benefits gained by not routing a vehicle on the Wednesday route.

Conclusion

Using the new routes will allow for more accountability, less drive time, and lower fuel costs. One recommendation would be to install GPS transponders on all of the service vehicles. Using the GPS results would help to verify the routes effectiveness, and may show areas for route improvement over time. GPS transponders would also help to ensure that drivers stick to the routes and that any deviations are reported on the log sheets.

References

Arentze, T. A., A.W. J. Borgers, and H. J. P. Timmermans. 1994. Multistop-based measuremtnes of accessibility in a GIS environment. International Journal of GIS 8:343-356.

Erden, T., M.Z. Coskun. 2007. The Analyzing Shortest and Fastest Paths with GIS and Determining Algorithm Running Time. VISUAL 3736:269-278.

Kim, B., S. Kim, and S. Sahoo. 2005. Waste collection vehicle routing problem with time windows. Computers & Operations Research 33:3624-3642.

Ljankowski, R. 1994. Integration of GIS-Based Suitability Analysis and Multicriteria Evaluation in a Spatial Decision-Support System for Route Selection. Environment and Planning B-Planning & Design 21:323-340.

Tavares, G., Z. Zsigraiova, V. Semiao, and M.G. Carvalho. 2009. Optimization of MSW collection routes for minimum fuel consumption using 3D GIS modeling. Waste Management 29:1176-1185.

Weigel, D., C. Buyang.1999. Applying GIS and OR Techniques to Solve Sears Technician-dispatching and Home-Delivery Problems. Interfaces 29:112-130.

Acknowledgements

A special thanks to :
Julie Parascondola at the Metro Parks Tacoma
Matthew Kelley at the University of Washington
Julie Masura at the University of Washington